United States Government Accountability Office

Report to Congressional Requesters

April 2019

2017 HURRICANE SEASON

Federal Support for Electricity Grid Restoration in the U.S. Virgin Islands and Puerto Rico

Accessible Version

GAO-19-296

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GAO Highlights

Highlights of GAO-19-296, a report to congressional requesters

Why GAO Did This Study

In 2017, Hurricanes Irma and Maria damaged much of the electricity grids' transmission and distribution systems in USVI and Puerto Rico. The hurricanes left most of USVI's 106,405 people and all of Puerto Rico's 3.3 million without power and resulted in the longest blackout in U.S. history.

Under the National Response Framework, electric utilities are responsible for repairing infrastructure and restoring service. They often use mutual assistance—voluntary partnerships with other electric utilities—to bring in additional resources to help restore electricity. Federal agencies provide financial assistance; help coordinate the federal response; and in severe emergencies, provide logistical support, such as assisting in damage assessments and location and transportation of repair crews and equipment.

GAO was asked to review the federal response to the 2017 hurricanes. This report provides information on federal support for restoring the electricity grids in Puerto Rico and USVI and factors affecting this support. GAO has ongoing work examining federal support to improve grid resilience in Puerto Rico.

GAO reviewed agency documents and funding data through July 20, 2018, the most recent data available; interviewed officials from FEMA, DOE, and USACE; and conducted site visits to Puerto Rico and USVI.

View GAO-19-296. For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov.

What GAO Found

Federal agencies supported efforts to restore electricity in the U.S. Virgin Islands (USVI) and Puerto Rico through the types of support they traditionally provide following disasters and, in Puerto Rico, in some unprecedented ways.

- **USVI.** Federal agencies provided traditional federal support to the electric utility's restoration efforts. For example, the Federal Emergency Management Agency (FEMA) provided financial assistance through its Public Assistance Program, and the Department of Energy (DOE) provided subject matter expertise to assist the local utility. In addition, the U.S. Army Corps of Engineers (USACE) provided generators for hospitals and other critical facilities. FEMA obligated about $795 million for these efforts as of July 20, 2018. According to the local utility, it took about 5 months for power to be restored to all customers with structures deemed safe for power restoration.
- **Puerto Rico.** In addition to the traditional types of support, FEMA and USACE undertook unprecedented roles of helping to coordinate and directly assist with grid restoration in Puerto Rico. FEMA requested that USACE lead federal grid repair efforts because of the scale of the damage and because the Puerto Rico Electric Power Authority (PREPA) did not have the capacity to respond, according to FEMA officials. FEMA obligated about $3.2 billion for electricity restoration efforts as of July 20, 2018, and PREPA estimated that it took roughly 11 months for power to be restored to all customers with structures deemed safe for power restoration.

U.S. Army Corps of Engineers (USACE) and Contractors Restore Electricity in Puerto Rico



Sources: (from left to right) Robert DeDeaux, USACE, Engineer Research and Development Center; Dave Palmer, USACE, Los Angeles District; and Preston Chasteen, USACE, Tulsa District. | GAO-19-296

Various factors affected federal support for electricity grid restoration, according to officials GAO interviewed and documents reviewed. For example, getting the crews and materials needed to islands was more difficult and time-consuming than on the mainland. In Puerto Rico, PREPA was insolvent, which presented challenges for restoring the grid. For example, PREPA canceled its vegetation management program; this contributed to the destruction of the grid when the hurricane arrived, according to FEMA officials. In addition, FEMA did not anticipate or plan for the extensive federal role in grid restoration in Puerto Rico, and USACE did not have a contract in place to immediately initiate grid repair efforts, according to USACE officials. FEMA and USACE identified potential actions to address these challenges, such as reviewing advance contracts.

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Abbreviations

DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
FEMA	Federal Emergency Management Agency
FPDS-NG	Federal Procurement Data System-Next Generation
PREPA	Puerto Rico Electric Power Authority
PROMESA	Puerto Rico Oversight, Management, and Economic Stability Act
USACE	U.S. Army Corps of Engineers
VIWAPA	Virgin Islands Water and Power Authority

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Congressional Requesters

In 2017, Hurricanes Irma and Maria damaged much of the electricity grids' transmission and distribution systems in Puerto Rico and the U.S. Virgin Islands, leaving millions without power and resulting in the longest blackout in U.S. history. These hurricanes brought some of the heaviest rain and strongest winds ever recorded to Puerto Rico and the U.S. Virgin Islands, causing unprecedented damage and the costliest hurricane season on record. Following the hurricanes, it took roughly 5 months for power to be restored to all of the customers in the U.S. Virgin Islands, which has an estimated population of 106,405 people, and roughly 11 months for power to be restored to all of the customers in Puerto Rico, which has an estimated population of 3.3 million people. According to the Virgin Islands Water and Power Authority (VIWAPA) and the Puerto Rico Electric Power Authority (PREPA), power has been restored to all customers with structures deemed safe for power restoration. This does not mean that all pre-storm customers have power, as some structures may not have been deemed safe for power restoration.

Under the federal government's National Response Framework, which describes how the federal government, states and localities, and other public and private sector institutions should respond to disasters and emergencies, electric utilities are responsible for repairing damaged electricity infrastructure and restoring services. Electric utilities often use mutual assistance—voluntary partnerships with other electric utilities—to bring in additional resources beyond those of the affected utility to help restore electricity.[1] Under the National Response Framework, when

[1]According to the Edison Electric Institute, the electric utility industry relies on mutual assistance networks to help speed restoration following major outages. Mutual assistance agreements are an essential part of the electric power industry's service restoration process and contingency planning, providing participating electric utilities with resources, such as equipment and lineworkers and other electric utility personnel, to help restore power when assistance is needed. These agreements provide a formal process for electric utilities to request support from other electric companies in parts of the country that have not been affected by major outages. Electric utilities affected by a major outage are thereby able to increase the size of their workforce by borrowing restoration workers from other companies. When called upon, a company will send skilled restoration workers—both company employees and contractors—along with specialized equipment to help with the restoration efforts of a fellow company.

appropriate, federal agencies provide financial assistance for response and recovery activities, help coordinate the response, gather and share information, and communicate with key stakeholders and the public. Also, in severe emergencies, federal agencies can provide some logistical support, such as assisting in damage assessments and locating and transporting repair crews and equipment.

The National Response Framework designates the Federal Emergency Management Agency (FEMA), a component of the Department of Homeland Security, to lead the coordination of federal disaster response efforts. The framework's 14 emergency support functions are the federal government's primary coordinating structure for building, sustaining, and delivering response capabilities during an emergency. For each of the 14 emergency support functions, a federal department or agency serves as the designated coordinator. The framework designates the Department of Energy (DOE) as the coordinating agency for federal efforts in the energy sector, which includes electricity.[2] In this role, DOE is responsible for coordinating with FEMA and other relevant federal agencies, such as the U.S. Army Corps of Engineers (USACE), and for collaborating with critical infrastructure owners and operators to prioritize and coordinate federal efforts. USACE is the coordinating agency for the public works and engineering emergency support function under the framework, which includes providing support for temporary emergency power, among other things.[3]

You asked us to review the federal government's response to the 2017 hurricanes. Our objective in this report was to describe federal support provided to help restore the electricity grids in Puerto Rico and the U.S. Virgin Islands in response to the 2017 hurricane season and the factors that affected this support. This is our first report related to electricity infrastructure in response to your request; we have ongoing work examining federal support to improve grid resilience in Puerto Rico.

[2]DOE is the coordinating agency for emergency support function 12, which is the energy-focused emergency support function under the National Response Framework.

[3]USACE is the coordinating agency for emergency support function 3, public works and engineering, which includes the provision of assets and services related to public works and engineering, such as temporary power. USACE assists FEMA by providing temporary emergency power, including the procurement, installation, operation and maintenance of generators, to critical public facilities when commercial power is interrupted by disasters.

To conduct this work, we reviewed documentation related to federal agency support to help restore electricity grids in response to the 2017 hurricane season in Puerto Rico and the U.S. Virgin Islands. Specifically, we reviewed the National Response Framework; FEMA mission assignment documents; and agency reports identifying lessons learned, such as FEMA's 2017 Hurricane Season FEMA After-Action Report, DOE's after action report for the 2017 hurricane season, and USACE's 2018 Remedial Action Program Senior Leader Briefing. We also reviewed documents related to FEMA's Public Assistance Program including FEMA's Public Assistance Program and Policy Guide and FEMA's Public Assistance Alternative Procedures (Section 428) Guide for Permanent Work in Puerto Rico.

We reviewed FEMA data on obligations for electricity restoration efforts in Puerto Rico and the U.S. Virgin Islands as of July 20, 2018, the most recent data available at the time of our review.[4] FEMA officials compiled obligations related to electricity restoration from two databases, the Emergency Management Mission Integrated Environment and the Enterprise Coordination and Approvals Processing System. To assess the reliability of these data, we reviewed existing information about the data and discussed data quality control procedures with FEMA officials. We determined that the data we used from these systems were sufficiently reliable for the purposes of this report. To identify USACE contract obligations for grid restoration in Puerto Rico, we reviewed Federal Procurement Data System-Next Generation (FPDS-NG) data through June 30, 2018, the most recent data available at the time of our review.[5] We assessed the reliability of FPDS-NG data by reviewing existing information about the FPDS-NG system and the data it collects, and compared FPDS-NG data to the contract files in our review. We determined that the FPDS-NG data were sufficiently reliable for the purposes of this report. We also reviewed PREPA's data on the number of lineworkers working on grid restoration efforts in Puerto Rico. We

[4]An obligation is a definite commitment that creates a legal liability of the government for the payment of goods and services ordered or received or a legal duty on the part of the United States that could mature into a legal liability by virtue of actions on the part of the other party beyond the control of the United States.

[5]For the purposes of this report, contract obligations include obligations against what the FPDS-NG categorizes as definitive vehicles (definitive contracts and purchase orders that have a defined scope of work that do not allow for individual orders under them) and against what FPDS-NG categorizes as indefinite delivery vehicles (including orders under indefinite delivery vehicles, such as indefinite delivery, indefinite quantity contracts).

assessed the reliability of PREPA's lineworker data by interviewing PREPA officials on how the data were collected and maintained, and we also discussed the reliability of the data with FEMA, USACE, and DOE officials. We found these data to be sufficiently reliable for our purposes.

We interviewed federal officials from FEMA, DOE, and USACE and representatives from two relevant industry organizations—the Edison Electric Institute and the American Public Power Association.[6] We also conducted site visits to Puerto Rico and the U.S. Virgin Islands to interview representatives of local government agencies; the electric utilities, PREPA and VIWAPA; and utility commissions.

To identify any factors that affected federal support for the restoration of electricity grids in Puerto Rico and the U.S. Virgin islands, we summarized officials' and representatives' views on any factors that affected federal support for the restoration of the electricity grids. We included those factors that were most often cited in interviews and documents we reviewed.

We conducted this performance audit from February 2018 to April 2019 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

This section provides information on the electricity provider, impact of 2017 hurricanes, and status of electricity restoration in Puerto Rico and the U.S. Virgin Islands. Also, it describes FEMA's Public Assistance Program.

[6]The Edison Electric Institute is an association that represents all U.S. investor-owned electric companies. The American Public Power Association is an association of not-for-profit, community-owned electric utilities.

Puerto Rico

Electricity provider. PREPA is a public power utility owned by the Commonwealth of Puerto Rico and a monopoly supplier of electricity in the commonwealth. It is also one of the nation's largest public power utilities, serving approximately 1.5 million customers. PREPA was approximately $9 billion in debt prior to Hurricanes Irma and Maria, and its electric power infrastructure was known to be in poor condition, largely due to underinvestment and poor maintenance practices.[7] In May 2018, we found that inadequate management of PREPA's financial condition contributed to Puerto Rico's persistent deficits.[8] Specifically, PREPA did not update or improve its electric generation and transmission systems, which hampered their performance and led to increased costs of producing electricity that it did not fully pass on to consumers. In addition, Puerto Rico's economy is in a prolonged period of economic contraction, and according to U.S. Census Bureau estimates, its population declined from a high of approximately 3.8 million people in 2004 to 3.3 million people in 2017, a decline of 12.8 percent. Along with the declining population, demand for electricity declined 18 percent from 2007 to 2017, according to PREPA.[9]

Impact of 2017 hurricanes. Hurricanes Irma and Maria in September 2017 left Puerto Rico's entire electricity grid inoperable, according to the economic and disaster recovery plan for Puerto Rico.[10] According to a

[7]Congressional Research Service, *Repair or Rebuild: Options for Electric Power in Puerto Rico* (Nov. 16, 2017). In July 2017, the Financial Oversight and Management Board for Puerto Rico put PREPA into a bankruptcy-like process. In June 2016, Congress enacted and the President signed the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) Pub. L. No. 114-187, in response to Puerto Rico's fiscal crisis. PROMESA established the Financial Oversight and Management Board for Puerto Rico, and granted it broad powers of fiscal and budgetary control over Puerto Rico. PROMESA also established a mechanism through which the Oversight Board could petition U.S. courts on Puerto Rico's behalf to restructure debt. Under federal bankruptcy laws, Puerto Rico is otherwise ineligible to authorize its municipalities and instrumentalities to petition U.S. courts to restructure debt. For more information on PROMESA, see GAO *Puerto Rico: Factors Contributing to the Debt Crisis and Potential Federal Actions to Address Them*, GAO-18-387 (Washington, D.C.: May 9, 2018).

[8]GAO-18-387.

[9]Puerto Rico Electric Power Authority, *Puerto Rico Electric Power Authority Fiscal Plan* (Aug. 1, 2018).

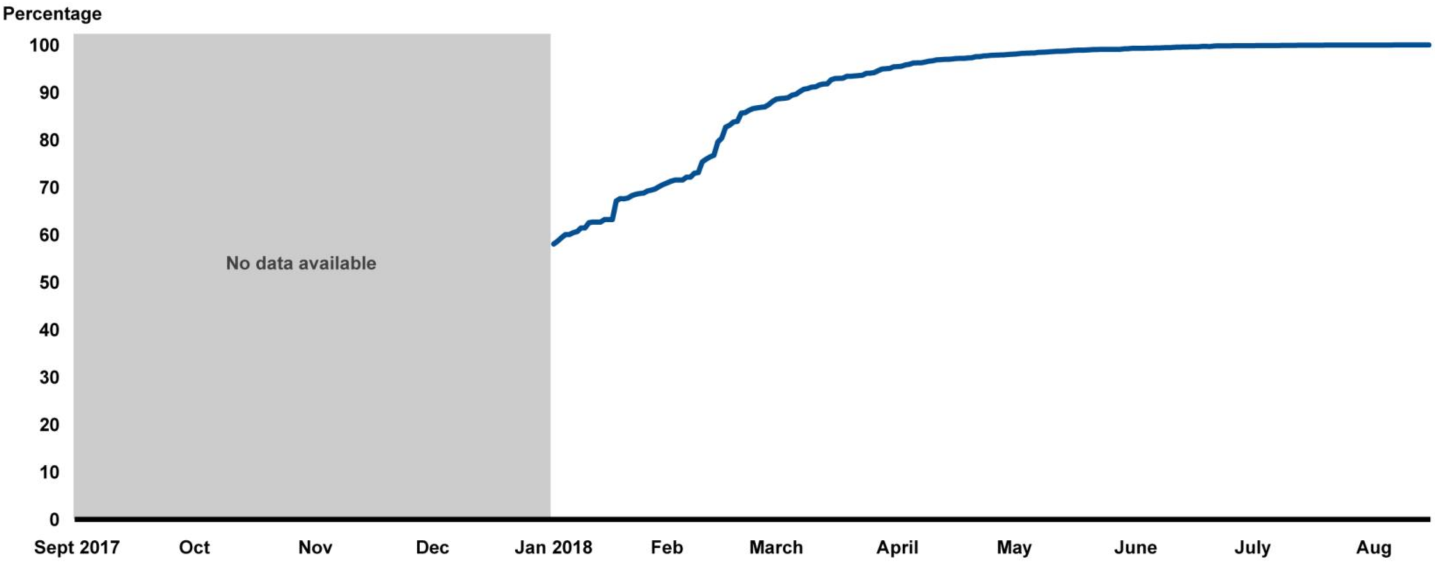
[10]Central Office for Recovery, Reconstruction, and Resiliency, *Transformation and Innovation in the Wake of Devastation: An Economic and Disaster Recovery Plan for Puerto Rico* (August 8, 2018).

report by a working group that included utilities and national laboratories, among others, because of the extended and unprecedented damage, a significant portion of the generation, transmission, and distribution system must be rebuilt, including high-voltage transmission lines that often survive lower category hurricanes.[11] While Puerto Rico's population had already been declining, the migration of people from Puerto Rico accelerated following the hurricanes, according to PREPA.

Status of electricity restoration. According to PREPA, it took roughly 11 months for power to be restored to all of the customers able to receive power safely in Puerto Rico following the hurricanes. A PREPA official told us that PREPA's estimates of customers with power restored are based on the number of meters that it knows are served by a given power line and on the number of meters it can read currently. Power has been restored to 100 percent of customers that are able to receive power safely, but this does not mean that all pre-storm customers have power restored, as some structures may not have been deemed safe for power restoration, according to PREPA officials. Figure 1 shows the percentage of customers with electricity restored in Puerto Rico beginning in January 2018 when PREPA was able to start estimating this information.

[11]Puerto Rico Energy Resiliency Working Group and Navigant Consulting, Inc., *Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico* (Dec. 11, 2017). The working group included the New York Power Authority; Puerto Rico Electric Power Authority; Puerto Rico Energy Commission; Consolidated Edison Company of New York; Inc.; Edison International; Electric Power Research Institute; Long Island Power Authority; Smart Electric Power Alliance; DOE; Brookhaven National Laboratory; National Renewable Energy Laboratory; Pacific Northwest National Laboratory; Grid Modernization Lab Consortium; and Public Service Electric and Gas Long Island.

Figure 1: Estimated Percentage of Customers Able to Receive Electricity with Electricity Restored in Puerto Rico from January 2018 through August 2018



Source: Puerto Rico Electric Power Authority (PREPA) estimates. | GAO-19-296

Note: PREPA's estimates of customers with power restored are based on the number of meters that PREPA knows are served by a given power line and on the number of meters PREPA can read currently, according to a PREPA official. Power has been restored to 100 percent of customers that are able to receive power safely, but this does not mean that all pre-storm customers have power restored, as some structures may not have been deemed safe for power restoration, according to PREPA officials.

Although PREPA estimates that electricity had been restored to all customers by August 2018, in some instances electricity service has been supported by temporary generators, and outages have continued. For example, as of December 11, 2018, USACE was supporting seven generators that were supporting micro grids for the island municipalities of Vieques and Culebra. These islands had previously been served by an undersea transmission line connecting the islands to PREPA's main grid on Puerto Rico. According to the U.S. Energy Information Administration, total electricity sales in Puerto Rico returned to pre–Hurricane Maria levels as of April and May 2018, although residential electricity sales appear to continue to lag historical levels, reflecting some continued outages.

U.S. Virgin Islands

Electricity provider. VIWAPA, a public utility, is a monopoly provider of electric power services in the U.S. Virgin Islands and serves approximately 55,000 customers throughout the territory. Like PREPA,

VIWAPA faced financial challenges before the hurricanes. The USVI Hurricane Recovery and Resilience Task Force Report noted that VIWAPA has a 17 percent non-payment rate across its customer base, a significant unfunded pension liability, and long-term debt commitments of $265 million.[12] In addition, the report states that the U.S. Virgin Island's energy system faces many challenges that have led to higher rates and a historically unreliable grid. These include an aging, inefficient, and oversized infrastructure and heavy reliance on imported fossil fuels. The report also says that peak demand declined 18 percent from 2011 through 2017, driven by a variety of factors, including population decline. In addition, the report says that VIWAPA's high energy rates and reliability issues have led some customers— particularly larger commercial and industrial ones—to leave the grid.

Impact of 2017 hurricanes. Hurricanes Irma and Maria damaged more than 90 percent of VIWAPA's aboveground power lines and over 20 percent of VIWAPA's generation capacity, according to the USVI Hurricane Recovery and Resilience Task Force Report. Specifically, the hurricanes damaged more than 20,000 poles and 1,100 miles of transmission and distribution lines, according to the report. Although 90 percent of VIWAPA's above ground power lines were damaged, this was far fewer than the miles of transmission and distribution lines damaged in Puerto Rico.

Electricity status. According to VIWAPA, following the hurricanes, it took roughly 5 months for power to be restored to all of the eligible customers in the U.S. Virgin Islands. Eligible customers were those whose homes were safely able to receive power. Some homes had suffered substantial damage to their electrical infrastructure from the hurricanes and were not able to receive power safely until their electrical equipment was repaired. VIWAPA's estimates of customers with power restored are based on the number of meters that VIWAPA knows are served by a given power line, as VIWAPA's automated system for determining the percentage of customers without power was destroyed and is still being restored, according to a FEMA official. Although electricity service has been restored, electricity demand has not recovered to prestorm levels. According to the USVI Hurricane Recovery and Resilience Task Force Report, VIWAPA's peak demand—the maximum energy load consumed

[12]USVI Hurricane Recovery and Resilience Task Force, *USVI Hurricane Recovery and Resilience Task Force Report (*2018).

by customers at any point in a year—was approximately 107 megawatts before the storms, but as of May 2018 it was 66 megawatts. The report says that demand will likely rebound to some degree as the territory rebuilds and recovers; however, it is unclear how quickly or by how much.

FEMA's Public Assistance Program

FEMA, in leading the coordination of federal disaster response efforts, provides assistance through its Public Assistance Program to state, territorial, local, and tribal governments and certain types of private nonprofit organizations to assist them in responding to and recovering from major disasters or emergencies. FEMA Public Assistance Program funds can be provided for

- emergency work, such as for emergency protective measures that must be done immediately to protect public health and safety;
- permanent work, which includes the restoration of disaster-damaged public utilities;[13] and
- management costs, which include indirect costs, administrative expenses, or other expenses that are not directly chargeable to a specific project and that a recipient or subrecipient incurs in administering and managing Public Assistance awards.

Generally, emergency work takes place for about 6 months following a disaster, while permanent work can take place over a decade, according to FEMA officials. FEMA can provide grants for both emergency and permanent work, and it can also provide direct federal assistance for emergency work. Under direct federal assistance, federal agencies directly perform or contract for the emergency work. FEMA's Public Assistance Program allows for the federal government to provide direct assistance at the request of the state, territorial, and local governments when the impact of an incident is so severe that the state, territorial, and local governments lack the capability to perform or contract eligible emergency work. Under the Public Assistance Program and the Stafford Act, FEMA may mission assign—issue a work order that directs another federal agency, such as DOE or USACE to utilize its authorities and the

[13]Grants for permanent work may also include cost-effective hazard mitigation to protect the facilities from future damage.

resources granted to it under federal law—in support of this direct assistance to state, local, and territorial governments.[14]

FEMA's Community Disaster Loan Program

The Community Disaster Loan program provides loans to local governments that have suffered substantial loss of tax and other revenue in areas included in a major disaster declaration. The loan funding may be used for existing essential municipal functions and expanded functions required to meet disaster-related needs, but not for capital improvements or repair or restoration of damaged public facilities.

The Federal Role in Electricity Grid Restoration Was Unprecedented in Puerto Rico, and Various Factors Affected the Support Provided in Puerto Rico and the U.S. Virgin Islands

Federal agencies provided traditional support to restore electricity in response to Hurricanes Irma and Maria in both Puerto Rico and the U.S. Virgin Islands—such as providing temporary power for critical facilities. They also provided unprecedented support in Puerto Rico by helping to coordinate efforts to repair Puerto Rico's electricity grid rather than primarily supporting the local utility's efforts. Factors that affected the electricity grid restoration efforts in Puerto Rico and the U.S. Virgin Islands included logistical constraints, availability of materials, the financial condition of local utilities, and the unprecedented and extensive role of federal agencies. Appendix I provides timelines of federal and other efforts to support electricity grid restoration in Puerto Rico and the U.S. Virgin Islands after the 2017 hurricane season.

[14]See 42 U.S.C. § 5192(a)(1); 44 C.F.R. § 206.2(a)(18). Mission assignments may be categorized as direct federal assistance when FEMA tasks agencies to provide eligible emergency work or debris removal services to state, local, tribal, or territorial governments following an emergency or major disaster declaration.

Federal Support Provided to Restore Electricity in Puerto Rico and the U.S. Virgin Islands in Response to the 2017 Hurricanes Included an Unprecedented Role for the Federal Government

Federal agencies assisted in the restoration of electricity after Hurricanes Irma and Maria in a variety of ways. FEMA provided billions in grants and direct federal assistance for electricity restoration. DOE provided subject matter expertise and coordination assistance. USACE provided temporary emergency power in Puerto Rico and the U.S. Virgin Islands. In addition, FEMA and USACE undertook unprecedented roles to help coordinate and directly assist with grid restoration in Puerto Rico.

Grants, direct federal assistance, and loans from FEMA. FEMA provided billions in grants and direct federal assistance to support electricity restoration in Puerto Rico and the U.S. Virgin Island through its Public Assistance Program. As public utilities, both PREPA and VIWAPA are eligible applicants for federal assistance through FEMA's Public Assistance Program for the repair, restoration, and replacement of public facilities damaged or destroyed by a major disaster.[15] As of July 20, 2018, FEMA had obligated approximately $3.2 billion for direct federal assistance through mission assignments and Public Assistance grant funds for electricity restoration in Puerto Rico and approximately $795 million for the U.S. Virgin Islands.[16] This includes $2 billion that FEMA obligated for direct federal assistance through mission assignments to USACE for temporary emergency power and grid restoration efforts in Puerto Rico. In the U.S. Virgin Islands, FEMA obligated $63 million for

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[15]Generally, under the Public Assistance Program, an eligible applicant who owns a public facility or facilities may receive grant assistance to repair or replace the facility to its predisaster design (its size and capacity) and function. Grants additionally cover eligible expenses that are required by current applicable codes and standards, provided the work is required as a direct result of the disaster. In addition, the Bipartisan Budget Act of 2018 includes a provision that for the duration of the recovery from Hurricanes Irma and Maria in Puerto Rico and the U.S. Virgin Islands, FEMA may provide, for critical services such as power, as defined in the Stafford Act, assistance to replace or restore the function of a facility or system to industry standards without regard to the predisaster condition of the facility.

[16]This includes funding for Public Assistance grants and direct federal assistance mission assignments that FEMA officials identified as related to power restoration, including temporary emergency power. It does not include funding for federal operational support mission assignments, which are those that task federal agencies with providing federal-to-federal support.

direct federal assistance related to electricity restoration, most of which was obligated to USACE and DOE. Table 1 shows FEMA funding obligations for electricity restoration efforts in Puerto Rico and the U.S. Virgin Islands.

Table 1: Federal Emergency Management Agency Public Assistance Obligations for Electricity Restoration in Puerto Rico and the U.S. Virgin Islands Following Hurricanes Irma and Maria, as of July 20, 2018

Territory	Grants (dollars)	Direct federal assistance (dollars)[a]	Total (dollars)[b]
Puerto Rico	1,195,861,552	2,003,600,000	**3,199,461,552**
U.S. Virgin Islands	731,943,655	63,070,000	**795,013,655**

Source: GAO analysis of Federal Emergency Management Agency (FEMA) data. | GAO-19-296

[a]Direct federal assistance is provided when FEMA issues a mission assignment for federal agencies to provide support when states or territories lack the resources to undertake emergency work and they request such assistance.

[b]In addition to federally provided funds, states and territories may have to pay some portion of the total cost, or the President may waive the cost share. In Puerto Rico the President authorized 100 percent federal funding for grid restoration until August 20, 2018, and for emergency temporary power support until September 19, 2018. In the U.S. Virgin Islands, the President authorized 100 percent federal funding until May 14, 2018, for emergency protective measures and September 15, 2018, for emergency temporary power support. In addition, the Insular Areas Act provides an administering agency discretion to waive any requirement for matching funds to be provided by the U.S. Virgin Islands or other specified territories.

In addition, FEMA provided $75 million to VIWAPA through the Community Disaster Loan program as of July 20, 2018, according to FEMA officials. FEMA officials said that the most common use for Community Disaster Loan funds is payroll, and other examples of eligible uses include employee benefits, facilities maintenance costs, and normal operating materials.

Coordination and technical assistance from DOE. DOE received mission assignments from FEMA and deployed staff from its headquarters, site offices, and power marketing administrations to provide subject matter expertise and technical assistance in support of electricity grid damage assessments and power restoration efforts in both Puerto Rico and the U.S. Virgin Islands. According to DOE officials, DOE’s primary role in the response efforts on Puerto Rico and the U.S. Virgin Islands was coordination and provision of subject matter experts, as is typical for DOE’s role as the lead agency for the energy sector emergency support function. In Puerto Rico, however, DOE provided more advisors for a longer period of time than would be typical because of the extent of the damage to the electricity grid in Puerto Rico and PREPA’s limited capacity to respond, according to DOE officials. Specifically, DOE staffed up to 12 project support advisors to Puerto Rico

from October 18, 2017, to August 8, 2018, and one supply chain support advisor from December 18, 2017, to March 16, 2018. These advisors provided subject matter expertise to USACE by reviewing construction plans and providing recommendations for prioritization, and scheduling and assisting in inventory management for incoming electrical grid equipment, among other things, according to DOE. In addition, in the U.S. Virgin Islands DOE deployed a team of 36 people from the Western Area Power Administration along with trucks and materials to help rebuild the electricity grid through a FEMA mission assignment.[17] DOE officials told us that the department is also providing ongoing support on how to improve grid resilience as part of grid restoration and recovery efforts in both Puerto Rico and the U.S. Virgin Islands.[18]

Temporary power from USACE. USACE provided temporary emergency power for critical facilities in Puerto Rico and the U.S. Virgin Islands. These temporary emergency power missions provided and maintained generators to deliver electricity to critical public facilities, such as hospitals and relief centers.[19] After receiving a FEMA mission assignment to provide temporary emergency power in Puerto Rico, USACE deployed its Emergency Power Planning and Response Team, USACE government employees, soldiers from the 249th Engineer Battalion, and contractors. USACE installed a record number of emergency electric generators in Puerto Rico—over 2,300—through the end of May 2018. The previous record was 310 emergency generators installed in response to Hurricane Katrina. On May 17, 2018, FEMA approved the extension of the USACE mission assignment for emergency power to November 30, 2018. This extension permitted USACE to continue its support for the more than 700 generators still in use throughout Puerto Rico at that time. FEMA later extended the mission

[17]The Western Area Power Administration is one of four power marketing administrations within DOE that operate electric systems and sell electricity generated at federally owned and operated hydroelectric dams. The assistance provided by the Western Area Power Administration in the U.S. Virgin Islands was similar to that provided by mutual assistance crews, though the power administration was paid for this work through a FEMA mission assignment to DOE rather than through reimbursement from the local utility.

[18]We have ongoing work examining agencies' efforts to support grid resilience and restoration in Puerto Rico, which we will report on in 2019.

[19]In Puerto Rico, FEMA also assigned USACE the task of maintaining and fueling hundreds of other nonfederal generators. Similar to its mission in Puerto Rico, USACE provided support in the U.S. Virgin Islands by installing generators for critical facilities, but FEMA contractors maintained and fueled those generators.

assignment until April 8, 2019. As of December 11, 2018, USACE was supporting 24 generators in Puerto Rico, seven of which were supporting micro grids for the island municipalities of Vieques and Culebra. In the U.S. Virgin Islands, USACE installed 180 generators as a part of its temporary emergency power mission. USACE's temporary emergency power mission for the U.S. Virgin Islands was completed in February 2018, and USACE is no longer supporting generators there.

Unprecedented Roles by FEMA and USACE in Puerto Rico. In addition to the typical roles federal agencies undertake in restoration activities, FEMA and USACE undertook unprecedented roles in Puerto Rico because of the severe and widespread impacts of Hurricane Maria and PREPA's limited capacity. For the first time in its history, FEMA undertook the role of helping to coordinate major electricity grid restoration because PREPA did not have the necessary capability, capacity, or structure to respond, according to FEMA officials. FEMA officials also noted that PREPA's workers were not only engaged in restoration work but were also victims dealing with the same post-hurricane effects as the rest of the population.

As part of its response, FEMA mission assigned USACE to lead federal efforts to repair Puerto Rico's electricity grid—a role USACE had not played in the past during a domestic disaster response. Specifically, on September 30, 2017, the FEMA Administrator tasked USACE with leading the planning, coordination, and integration of the grid restoration. FEMA assigned USACE to lead federal efforts and provide direct support for grid restoration because PREPA was overwhelmed and had liquidity issues and USACE had the structures in place to award contracts with and bring in grid restoration crews, according to FEMA officials. In order to carry out its mission assignment, USACE issued contracts to bring lineworkers and materials to Puerto Rico to support the reinstallation and repair of transmission and distribution lines, among other power restoration activities.[20] As of June 30, 2018, USACE had obligated approximately $1.5 billion on these contracts. Figure 2 shows USACE and its contractors working to restore electricity in Puerto Rico. USACE's grid restoration mission assignment from FEMA ended on May 18, 2018, because, according to FEMA officials, power had been restored to

[20]Specifically, USACE issued contracts for the labor, equipment, materials, and supervision required to restore electrical transmission and distribution systems; to repair electrical generation systems, such as existing PREPA power plants; and to provide temporary generators.

approximately 98 percent of customers and PREPA, with its remaining contractors, had adequate capability to do the remaining work.

Figure 2: U.S. Army Corps of Engineers (USACE) and USACE Contractors Working to Restore Electricity in Puerto Rico



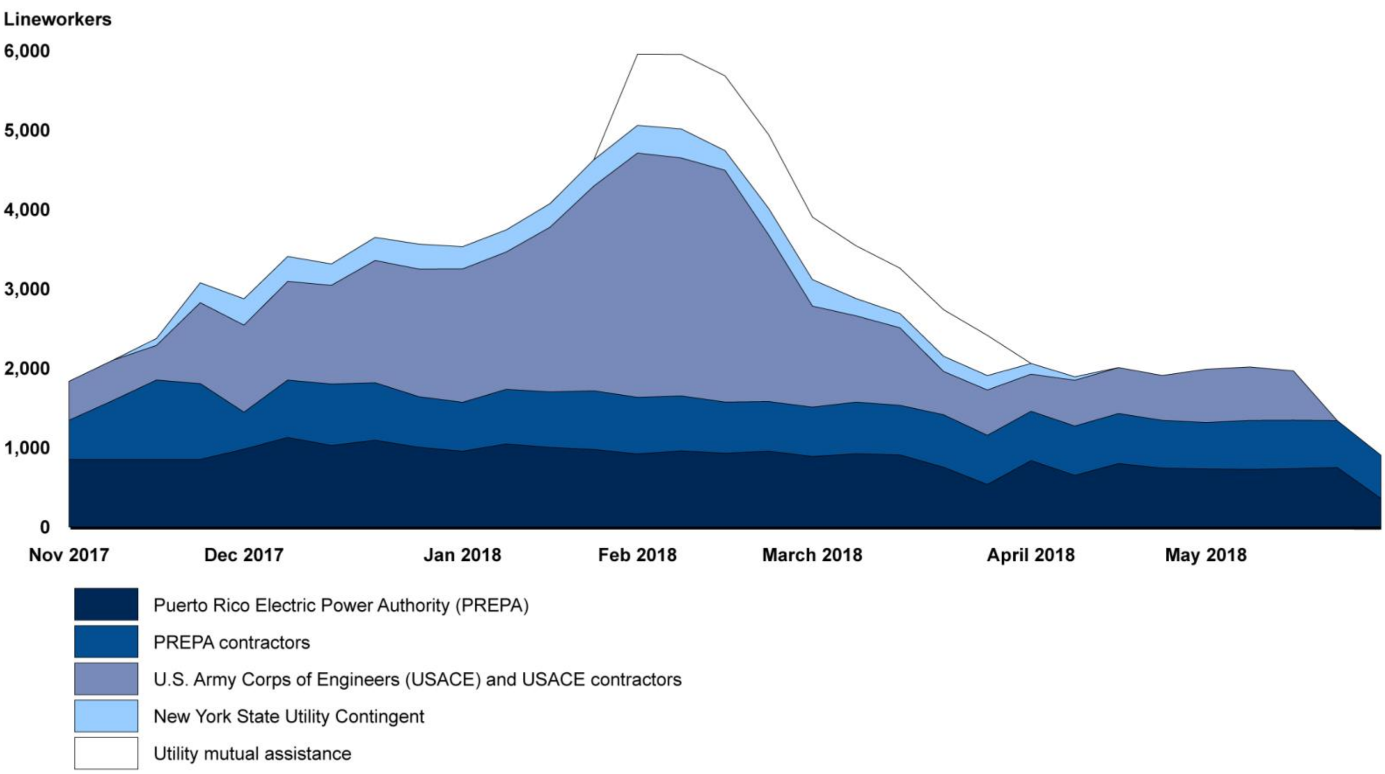
Sources: (from left to right) Robert DeDeaux, USACE, Engineer Research and Development Center; Dave Palmer, USACE, Los Angeles District; and Preston Chasteen, USACE, Tulsa District. | GAO-19-296

In addition to the federal response, PREPA issued its own contracts to bring in additional lineworkers, received assistance from the New York State Utility Contingent, and requested and received mutual assistance from other utilities.[21] PREPA did not initially reach out for mutual assistance. About 6 weeks following Hurricane Maria, on October 31, 2017, PREPA formally requested aid from other utilities on the mainland through the American Public Power Association and the Edison Electric Institute. The electric power industry sent two individuals to Puerto Rico on November 3, 2017 and they began assessing storm damage and working with PREPA, FEMA, USACE, and DOE officials to develop a

[21]Specifically, the Governor of Puerto Rico requested assistance from the Governor of New York through the Emergency Management Assistance Compact—a mutual aid agreement among member states that provides a legal framework for requesting resources. New York utilities established the New York State Utility Contingent to organize and deploy resources to Puerto Rico. The Office of the Governor of New York provided leadership, and the New York Power Authority and Consolidated Edison Company of New York, Inc. coordinated the contingent. According to the New York State Utility Contingent's after action report, using the Emergency Management Assistance Compact rather than traditional utility mutual assistance required a unique set of processes, procedures, financial accounting, and restrictions to which the utilities are traditionally not accustomed. See New York State Utility Contingent, *Emergency Response to Hurricane Maria: After Action Report* (White Plains, N.Y.: August 2018).

restoration plan. On November 22, 2017, the Governor of Puerto Rico appointed one of these individuals as Power Restoration Coordinator to oversee the multipronged restoration effort. According to the Power Restoration Coordinator, as a first step he worked to create an incident command structure, and incident management teams began arriving in December. Once the incident command structure was in place, the industry deployed additional crews, equipment and materials in January to accelerate the ongoing restoration efforts across the island. As discussed previously, local utilities are typically responsible for restoring service, with federal agencies providing financial and other support. In contrast, approximately half of the lineworkers working to restore the electricity grid in Puerto Rico were USACE or USACE contractors at the peak of restoration efforts in February 2018, as shown in figure 3.

Figure 3: Number of Lineworkers Who Worked to Restore the Electricity Grid in Puerto Rico from November 2017 through May 2018



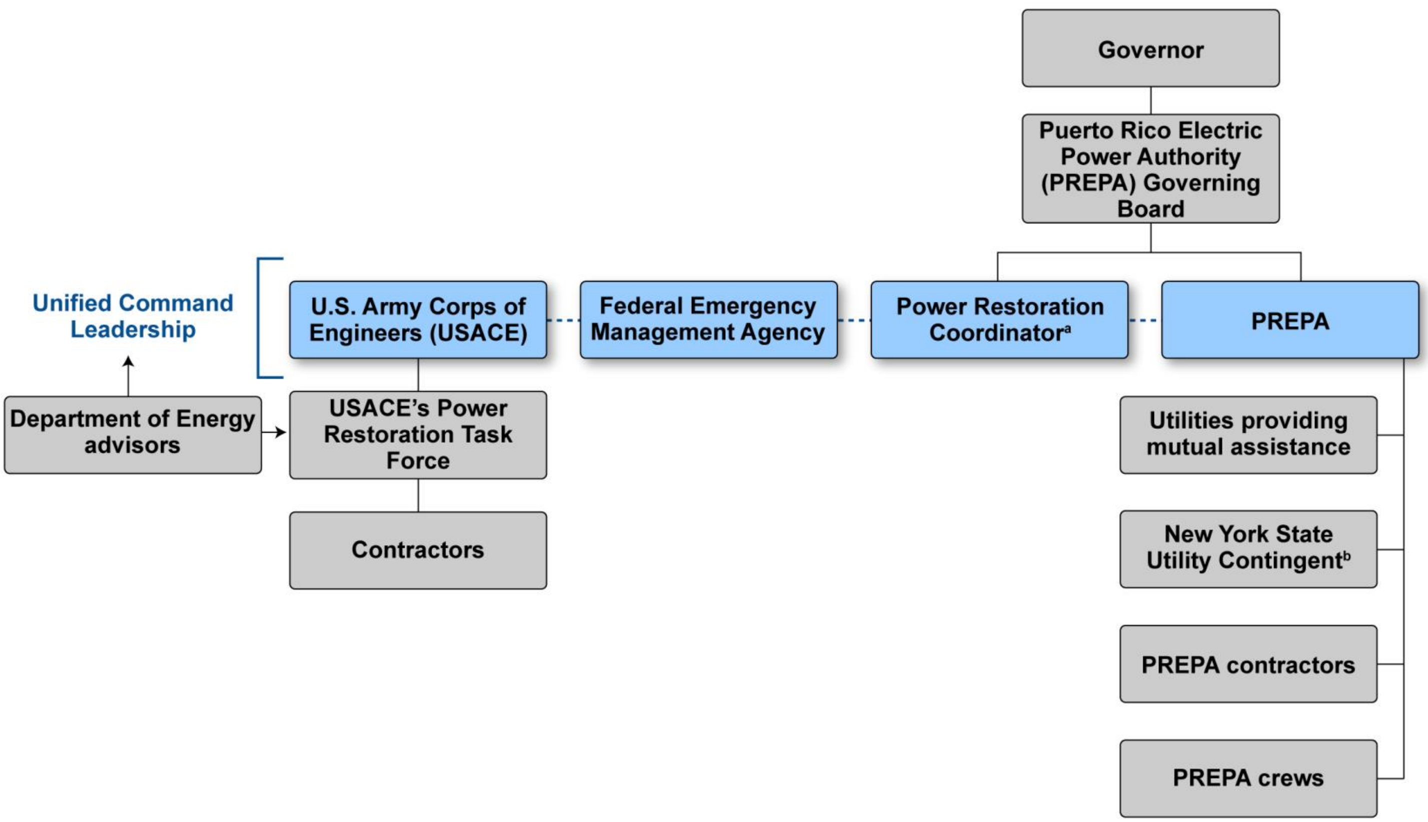
Source: GAO analysis of PREPA information. | GAO-19-296

Note: Electric utilities often use mutual assistance—voluntary partnerships with other electric utilities—to bring in additional resources beyond those of the affected utility to help restore electricity. New York utilities established the New York State Utility Contingent to organize and deploy resources

to Puerto Rico. The Office of the Governor of New York provided leadership, and the New York Power Authority and Consolidated Edison Company of New York, Inc. coordinated the contingent.

FEMA established a unified command structure to coordinate efforts of federal agencies, PREPA, PREPA's contractors, the New York State Utility Contingent, and utilities providing mutual assistance to PREPA, to help target priority work, ensure that crews could get to the work, and identify needed materials. Figure 4 shows the unified command structure.

Figure 4: Unified Command Structure for Electricity Grid Restoration in Puerto Rico



Source: GAO analysis of Federal Emergency Management Agency information. | GAO-19-296

[a]The Governor of Puerto Rico appointed a Power Restoration Coordinator to oversee the multipronged restoration effort.

[b]New York utilities established the New York State Utility Contingent to organize and deploy resources to Puerto Rico. The Office of the Governor of New York provided leadership, and the New York Power Authority and Consolidated Edison Company of New York, Inc. coordinated the contingent.

Logistical Challenges and Other Factors Affected Federal Support to Restore Electricity

According to documents we reviewed and our interviews with officials and representatives, the most commonly cited factors that affected federal electricity grid restoration efforts in Puerto Rico and the U.S. Virgin Islands included (1) logistical challenges, (2) availability of materials, (3) financial condition of local utilities and poor condition of existing infrastructure, and (4) the extensive and unprecedented role of federal agencies.

- **Logistical challenges.** Responding to disasters on islands presents a number of logistical challenges. Specifically, according to federal officials, getting the crews, equipment, and materials needed to support restoration efforts to an island was more difficult and time-consuming than doing so on the mainland. This includes prepositioning assets, such as generators, and delivering equipment and materials in advance of a storm. The difficulties were greater in the days following the hurricanes since neither the ports nor the airports in Puerto Rico and the U.S. Virgin Islands had power, which prevented the delivery of materials to the islands. In Puerto Rico, the Port of San Juan reopened for daylight operations 3 days after Hurricane Maria made landfall; every airport and seaport had limited capacity after reopening for approximately 7 days post-landfall, according to FEMA's 2017 Hurricane Season After-Action Report.[22] Federal officials in the U.S. Virgin Islands told us that they faced further delays locating key supplies because of inadequate labelling of shipping containers at the port. For example, some containers were marked only as disaster supply equipment, which did not sufficiently identify the contents within them. According to USACE's 2018 Remedial Action Program Senior Leader Briefing, USACE lacked the expertise and capabilities to manage the large operational logistics requirements to support the Puerto Rico and U.S. Virgin Islands response.[23]

[22]Federal Emergency Management Agency, *2017 Hurricane Season FEMA After-Action Report* (Washington, D.C.: July 12, 2018). The report identifies lessons learned from the 2017 hurricane season to target improvements in FEMA's response and recovery operations.

[23]U.S. Army Corps of Engineers, *Remedial Action Program Senior Leader Briefing* (July 19, 2018).

- **Availability of materials.** The sequence of three hurricanes making landfall in the United States in 2017 and the need to restore electricity service in Texas, Florida, and elsewhere, in addition to Puerto Rico and the U.S. Virgin Islands, complicated the restoration effort in the two territories. Since utilities in all affected areas were acquiring materials to restore electricity service, demand for these materials increased and available supplies were generally low; in some instances materials were only available as they were manufactured. Few, if any, materials were stockpiled locally on Puerto Rico. In addition, some of the equipment used in Puerto Rico was not standard in the continental United States and required ordering of specialized materials, resulting in delays in the restoration process. The U.S. Virgin Islands also faced supply issues, which became worse once grid recovery work in Puerto Rico began.
- **Financial condition of local utilities and poor condition of existing infrastructure.** Electric utilities in both Puerto Rico and the U.S. Virgin Islands were insolvent, which led to a lack of maintenance and presented its own challenges for restoring the grids after the storms. Specifically, PREPA was approximately $9 billion in debt before the 2017 hurricane season, with annual costs that exceeded its revenues. Puerto Rico's electric power infrastructure was in poor condition before the 2017 hurricane season largely because of PREPA's underinvestment and poor maintenance practices. For example, PREPA canceled its vegetation management program because of its financial situation; this contributed to the destruction of transmission and distribution lines when the hurricane arrived, according to FEMA officials.

  Similarly, in the U.S. Virgin Islands, financial challenges contributed to the extent of the damage to grid infrastructure. Specifically, VIWAPA officials told us that VIWAPA's financial challenges prevented certain infrastructure improvements and a large proportion of the electricity poles were at or above their weight capacity, increasing the likelihood and extent of wind damage during the hurricanes. According to VIWAPA officials, VIWAPA was aware that there were too many lines and heavy transformers on old poles, but was not in a position to address this concern prior to the hurricanes.
- **Extensive and unprecedented role of federal agencies.** FEMA did not anticipate or plan for the extensive role that it and USACE played in grid restoration in Puerto Rico. According to FEMA's after action report for the 2017 hurricane season, FEMA's planning assumptions

for a hurricane, earthquake, or tsunami striking Puerto Rico and the U.S. Virgin Islands underestimated the actual requirements.[24] As discussed above, prior to Hurricane Maria in Puerto Rico, USACE had never worked on a large-scale power restoration as part of a domestic disaster response and did not have expertise in this area, according to USACE officials. This affected grid restoration efforts. For example, USACE did not have a grid restoration contract in place to immediately initiate grid repair efforts, according to USACE officials. Rather, USACE issued an order off of a pre-existing contract that it had under its public works and engineering support function to bring electric utility lineworkers to Puerto Rico. According to USACE officials, a bid protest against one of USACE's contracts delayed its ability to increase the contract to bring more lineworkers to Puerto Rico.[25] In addition, the contract review and approval process USACE used to obtain supplies took longer than it would typically take utilities to get supplies, according to FEMA officials we interviewed.[26] According to USACE officials, USACE followed federal acquisition regulations, which is a slow process compared to private party purchases. USACE officials said that USACE is considering looking at what would be needed to create an advance grid restoration contract.

FEMA, USACE, and DOE identified potential actions to address these challenges. According to its after action report, FEMA plans to establish a standing interagency Power Task Force to coordinate with DOE, USACE, and state and local governments and provide crisis planning for the energy sector emergency support function to support the restoration of power during future national response efforts.[27] USACE's 2018 Remedial Action Program Senior Leader Briefing made recommendations to improve contingency contracting and operational logistics, among other things.[28] Specifically, recommendations included that USACE review

[24]Federal Emergency Management Agency, *2017 Hurricane Season FEMA After-Action Report*.

[25]A bid protest is a challenge to the award or proposed award of a contract for the procurement of goods and services or a challenge to the terms of a solicitation for such a contract.

[26]According to USACE officials, contracting inefficiencies, such as changes in the scope of work led to some delays. We are conducting a review of 2017 post-disaster contracts, which we plan to issue in 2019.

[27]Federal Emergency Management Agency, *2017 Hurricane Season FEMA After-Action Report*.

[28]U.S. Army Corps of Engineers, *Remedial Action Program Senior Leader Briefing* (July 19, 2018).

existing and planned advance contracts and make adjustments as necessary to increase capacity and improve capabilities, and that USACE work with FEMA to convene an interagency logistics planning team and identify logistics contracting gaps and propose government and private sector solutions. DOE's after action report for the 2017 hurricane season says that the lessons learned from the response to Hurricane Maria may prompt some programmatic improvements to the energy sector emergency support function roles and responsibilities related to island response, among other potential improvements.[29] In addition, the report states that because of the extensive damage to grid infrastructure and the length of the restoration and recovery, there is an increasing need to incorporate resilience and hardening into restoration, recovery, and mitigation planning and execution.

Agency Comments

We provided a draft of this report to the Department of Defense (DOD), the Department of Homeland Security (DHS), DOE, and the governments of Puerto Rico and the U.S. Virgin Islands for review and comment. In its comments, reproduced in appendix II, DHS indicated that a top priority of DHS, FEMA and the entire federal government has been to provide life safety and life-sustaining resources to Puerto Rico and the U.S. Virgin Islands, including efforts to restore power and stabilize critical infrastructure. DHS, DOD, and DOE also provided technical comments, which we incorporated as appropriate.

[29]Department of Energy, *2017 Response Season: After Action Report/Improvement Plan* (May 11, 2018). The report identifies observations related to DOE's emergency support function 12 response to the 2017 response season and is focused on lessons learned for DOE's internal use.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, the Secretary of Energy, the Secretary of Homeland Security, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.



Frank Rusco
Director, Natural Resources and Environment

List of Requesters

The Honorable Michael Enzi
Chairman
Committee on the Budget
United States Senate

The Honorable Ron Johnson
Chairman
The Honorable Gary C. Peters
Ranking Member
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Rand Paul
Chairman
Subcommittee on Federal Spending Oversight and Emergency Management
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Marco Rubio
Chairman
Committee on Small Business and Entrepreneurship
United States Senate

The Honorable Maxine Waters
Chairwoman
Committee on Financial Services
House of Representatives

The Honorable Sean P. Duffy
Ranking Member
Subcommittee on Housing, Community Development and Insurance
Committee on Financial Services
House of Representatives

The Honorable Al Green
Chairman
Subcommittee on Oversight Investigations
Committee on Financial Services
House of Representatives

The Honorable Bennie G. Thompson
Chairman
Committee on Homeland Security
House of Representatives

The Honorable Elijah E. Cummings
Chairman
The Honorable Jim Jordan
Ranking Member
Committee on Oversight and Reform
House of Representatives

The Honorable Nydia Velázquez
Chairwoman
Committee on Small Business
House of Representatives

The Honorable Peter A. DeFazio
Chairman
The Honorable Sam Graves
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Emanuel Cleaver, II
House of Representatives

The Honorable Michael McCaul
House of Representatives

The Honorable Gary Palmer
House of Representatives

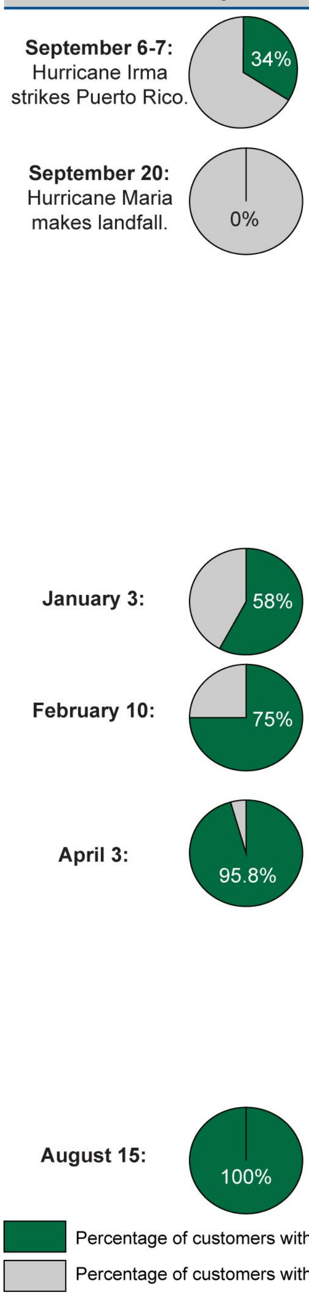
The Honorable Ann Wagner
House of Representatives

Appendix I: Timelines of Federal and Other Efforts to Support Electricity Grid Restoration

See figures 5 and 6 for a timeline of federal and other efforts to support electricity grid restoration in Puerto Rico and the U.S. Virgin Islands after the 2017 hurricane season.

Figure 5: Timeline of Federal and Other Efforts to Support Electricity Grid Restoration in Puerto Rico after the 2017 Hurricane Season

Estimate of customers with electricity[a]



2017	
September	**Sept. 10:** Major disaster declaration for Puerto Rico (DR-4336-PR). **Sept. 20:** Major disaster declaration for Puerto Rico (DR-4339-PR).[b] **Sept. 21-22:** The Governor of Puerto Rico requests emergency assistance from the Governor of New York, and New York sends its first group of 10 personnel to assist with the assessment and reconstruction of the grid. **Sept. 26:** The Puerto Rico Electric Power Authority (PREPA) awards a contract for grid restoration that is terminated effective November 30, 2017. **Sept. 30:** The Federal Emergency Management Agency (FEMA) assigns the U.S. Army Corps of Engineers (USACE) to lead planning, coordination, and integration efforts for grid restoration.
October	**Oct. 15-18:** USACE awards two contracts to assist with grid restoration.[c] **Oct. 19:** PREPA awards another contract for grid restoration. **Oct. 31:** PREPA requests mutual assistance from the electric utility industry.
November	**Nov. 22:** The Governor of Puerto Rico appoints a Power Restoration Coordinator to oversee the multipronged restoration effort.
December	**Dec. 1:** USACE awards a third contract for grid restoration. The total amount obligated on these three USACE-funded contracts is $1.5 billion as of June 30, 2018.
2018	
January	
February	
March	
April	
May	**May 17:** FEMA extends USACE's mission assignment for temporary emergency power to November 30, 2018. It is later extended until April 8, 2019. **May 18:** The USACE grid restoration mission ends.[d]
June	**June 20:** The Department of Energy made recommendations to Puerto Rico's government to inform investments in grid resilience included in recovery plans.
July	
August	

Source: GAO analysis of information from FEMA, PREPA, USACE, the Department of Energy, the New York State Utility Contingent, and the Office of the Governor of Puerto Rico. | GAO-19-296

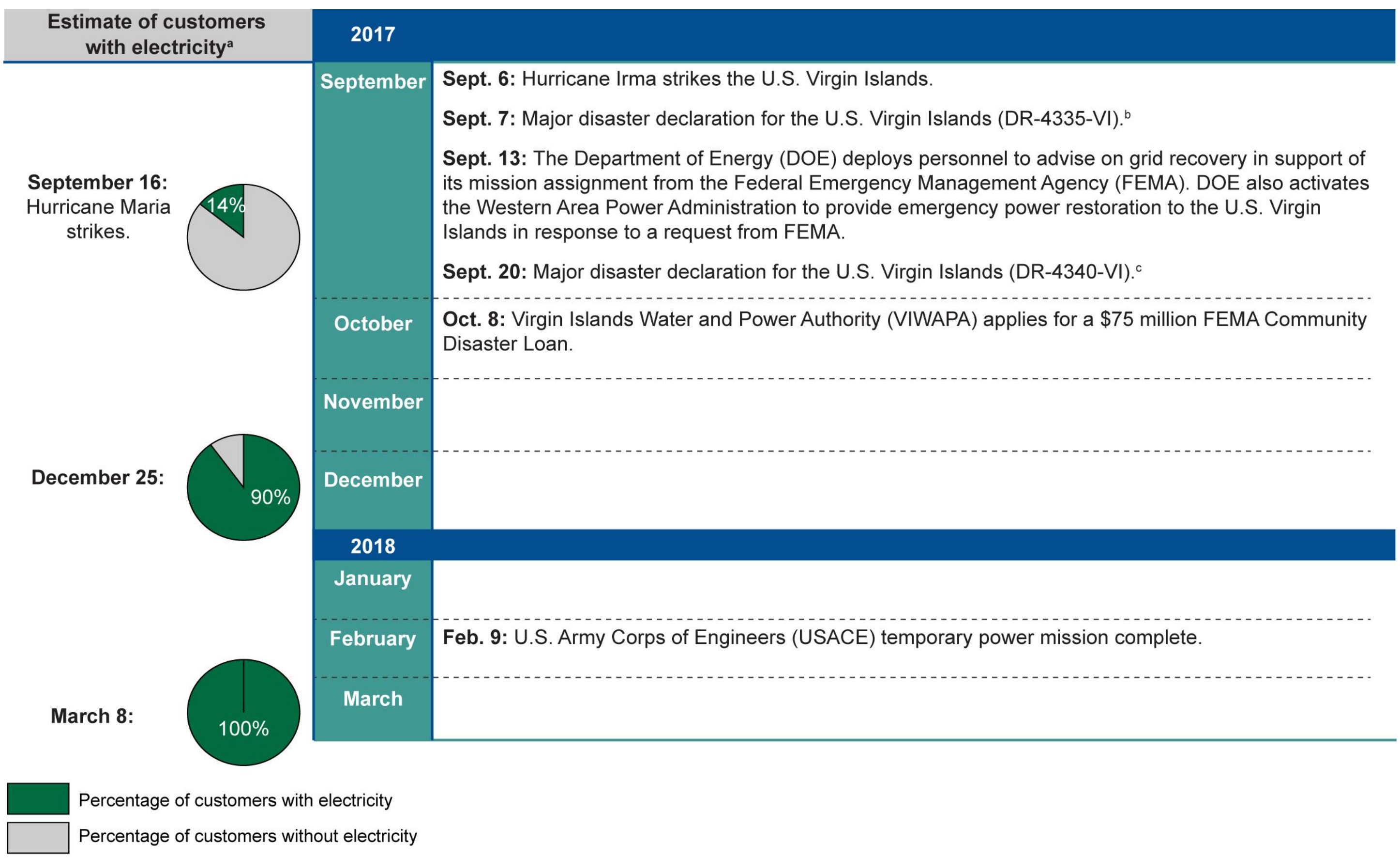
[a]PREPA's estimates of customers with power restored are based on the number of meters that PREPA knows are served by a given power line and on the number of meters PREPA can read currently, according to a PREPA official. Power has been restored to 100 percent of customers that are able to safely receive power, but this does not mean that all prestorm customers have power restored, as some structures may not have been deemed safe for power restoration, according to PREPA officials.

[b]The declaration was amended on September 26, 2017 to authorize increased cost sharing to 100 percent for emergency protective measures beginning September 17, 2017, including direct federal assistance, for 180 days from the start of the incident period. The100 percent federal funding was later extended until August 16, 2018, for power restoration and until September 15, 2018, for emergency temporary power.

[c]For the purposes of this report, contract obligations include obligations against what the Federal Procurement Data System-Next Generation (FPDS-NG) categorizes as definitive vehicles (definitive contracts and purchase orders that have a defined scope of work that do not allow for individual orders under them) and against what FPDS-NG categorizes as indefinite delivery vehicles (including orders under indefinite delivery vehicles, such as indefinite delivery, indefinite quantity contracts).

[d]USACE will no longer provide line restoration work for PREPA, but FEMA extended USACE's logistics and materials management capability until PREPA can effectively manage the volume of emergency restoration materials.

Figure 6: Timeline of Federal and Other Efforts to Support Electricity Grid Restoration in the U.S. Virgin Islands after the 2017 Hurricane Season



Source: GAO analysis of USACE, FEMA, and VIWAPA documents. | GAO-19-296

Note: VIWAPA contracted for assistance with restoring electricity and also received mutual assistance, according to VIWAPA officials.

[a]The share of customers with power restored is out of the total number of customers deemed safe for power restoration, according to VIWAPA. This does not mean that all prestorm customers have power, as some structures may not have been deemed safe for power restoration. VIWAPA's estimates of customers with power restored are based on the number of meters that VIWAPA knows are served by a given power line, as VIWAPA's automated system for determining the percentage of customers without power was destroyed and is still being restored, according to a FEMA official.

[b]The declaration was amended on September 28, 2017, to authorize increased cost sharing to 100 percent for emergency protective measures beginning September 6, including direct federal assistance, for 180 days from the start of the incident period and a 90 percent federal cost share thereafter. On March 15, 2018, the 100 percent federal funding for emergency protective measures was extended for 60 days, and on May 18, 2018, the 100 percent federal funding for emergency temporary power support was extended for 120 days.

[c]The declaration was amended on October 3, 2017, to authorize increased cost sharing to 100 percent for emergency protective measures beginning September 16, including direct federal assistance, for 180 days from the start of the incident period and a 90 percent federal cost share thereafter. On March 15, 2018, the 100 percent federal funding for emergency protective measures was extended for 60 days, and on May 18, 2018 the 100 percent federal funding for emergency temporary power support was extended for 120 days.

Appendix II: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528

Homeland Security

April 2, 2019

Chris P. Currie
Director, Homeland Security and Justice Issues
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Re: Management Response to Draft Report GAO-19-296, "2017 HURRICANE SEASON: Federal Support for Electricity Grid Restoration in the U.S. Virgin Islands and Puerto Rico"

Dear Mr. Currie:

Thank you for the opportunity to review and comment on this draft report. The U.S. Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's positive acknowledgement of the Federal Emergency Management Agency's (FEMA's) unprecedented role in coordinating and directly assisting with electricity grid restoration efforts in Puerto Rico and U.S. Virgin Islands (USVI) after Hurricanes Irma and Maria in 2017. As of July 20, 2018, FEMA had obligated $3.2 billion in Puerto Rico and $795 million in the USVI in both Public Assistance grant funds and direct federal assistance through mission assignments. A top priority of DHS, FEMA and the entire federal government has been continuing to provide life safety and life sustaining resources to Puerto Rico and USVI, including efforts to restore power and stabilize critical infrastructure.

In Puerto Rico, FEMA's 2019 Puerto Rico Contingency Plan includes the use of historical data to identify critical facilities that will need generators. To meet this requirement FEMA not only identified the number of generators needed, but also added generators with higher capacities. To improve resiliency of the electric grid in the USVI, the USVI Water and Power Authority (WAPA) is replacing wooden poles with composite poles which can withstand wind speeds of 200 miles per hour. USVI WAPA is also working on a plan to further improve resiliency by putting electric utility lines underground.

The National Response Framework (NRF) is part of the National Strategy for Homeland Security that presents the guiding principles enabling all levels of domestic response partners to prepare for and provide a unified national response to disasters and emergencies. The NRF is one of 5 frameworks established as part of the National Preparedness System which includes the National Frameworks for Prevention, Protection, Response, Recovery, and Mitigation as well as the National Preparedness Goal. The NRF designates FEMA as the lead coordinator of the 14 agencies supporting each function for federal response efforts. In building capabilities to restore Puerto Rico and USVI electricity grids, FEMA coordinated efforts with the Department of Energy (DOE), United States Army Corps of Engineers (USACE), Puerto Rico Electric Power Authority (PREPA), and USVI WAPA.

FEMA also formed the Emergency Power Task Force (TEPTF) to validate the stock and current status of the FEMA/Federal generators that have been stored in Puerto Rico. The TEPTF will coordinate with its Federal partners to initiate the installation of generators based on Puerto Rico's stated priorities, when needed. The TEPTF, which includes the DOE and USACE, meets quarterly to discuss topics related to interagency and private sector coordination, collaboration, and support. If needed, the TEPTF will evolve into a Crisis Action Planning Team to support FEMA's National Response Coordination Center and Regional Response Coordination Center activations.

The draft report did not contain any recommendations. Technical comments were previously provided under separate cover. FEMA remains committed to supporting our citizens and first responders before, during, and after disasters.

Again, thank you for the opportunity to review and comment on this draft report. We look forward to working with you again in the future. Please feel free to contact me if you have any questions.

Sincerely,

JIM H. CRUMPACKER, CIA, CFE
Director
Departmental GAO-OIG Liaison Office

2

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Frank Rusco, (202) 512-3841 or ruscof@gao.gov

Staff Acknowledgments

In addition to the contact named above, Quindi Franco (Assistant Director), Marya Link (Analyst in Charge), Janice Ceperich, William Gerard, Cindy Gilbert, Joseph Maher, David Marroni, Bolko Skorupski, Sheryl Stein, and Jarrod West made key contributions to this report.

Appendix IV: Accessible Data

Data Tables

Accessible Data for Figure 1: Estimated Percentage of Customers Able to Receive Electricity with Electricity Restored in Puerto Rico from January 2018 through August 2018

Date	Percentage
1/3/2018	58.05730%
1/4/2018	58.67067%
1/5/2018	59.40414%
1/6/2018	60.05146%
1/7/2018	60.05146%
1/8/2018	60.44990%
1/9/2018	60.67889%
1/10/2018	61.45227%
1/11/2018	61.45227%
1/12/2018	62.53666%
1/13/2018	62.69559%
1/14/2018	62.69559%
1/15/2018	62.69559%
1/16/2018	63.21331%
1/17/2018	63.21331%
1/18/2018	63.21331%
1/19/2018	67.13612%
1/20/2018	67.62614%
1/21/2018	67.58310%
1/22/2018	67.74800%
1/23/2018	68.25336%
1/24/2018	68.53048%
1/25/2018	68.70523%
1/26/2018	68.79022%
1/27/2018	69.23232%
1/28/2018	69.41724%
1/29/2018	69.67393%
1/30/2018	70.17909%

Date	Percentage
1/31/2018	70.59375%
2/1/2018	70.92417%
2/2/2018	71.28839%
2/3/2018	71.53041%
2/4/2018	71.55472%
2/5/2018	71.55472%
2/6/2018	72.15682%
2/7/2018	72.15682%
2/8/2018	72.98215%
2/9/2018	73.10937%
2/10/2018	75.34922%
2/11/2018	75.93951%
2/12/2018	76.41005%
2/13/2018	76.76762%
2/14/2018	79.57230%
2/15/2018	80.37644%
2/16/2018	82.68642%
2/17/2018	83.08900%
2/18/2018	83.76870%
2/19/2018	83.89606%
2/20/2018	85.64243%
2/21/2018	85.74711%
2/22/2018	86.24080%
2/23/2018	86.60027%
2/24/2018	86.74080%
2/25/2018	86.85920%
2/26/2018	86.94379%
2/27/2018	87.42682%
2/28/2018	88.11045%
3/1/2018	88.59016%
3/2/2018	88.71460%
3/3/2018	88.77040%
3/4/2018	88.90543%
3/5/2018	89.42926%
3/6/2018	89.61623%
3/7/2018	90.18941%
3/8/2018	90.68079%

Date	Percentage
3/9/2018	90.81636%
3/10/2018	91.11792%
3/11/2018	91.17943%
3/12/2018	91.58703%
3/13/2018	91.78608%
3/14/2018	91.80889%
3/15/2018	92.67244%
3/16/2018	92.93035%
3/17/2018	92.96334%
3/18/2018	93.00353%
3/19/2018	93.39898%
3/20/2018	93.39898%
3/21/2018	93.48262%
3/22/2018	93.55282%
3/23/2018	93.62756%
3/24/2018	94.02688%
3/25/2018	94.06008%
3/26/2018	94.17332%
3/27/2018	94.56225%
3/28/2018	94.94060%
3/29/2018	95.00597%
3/30/2018	95.06293%
3/31/2018	95.40156%
4/1/2018	95.44501%
4/2/2018	95.51392%
4/3/2018	95.79674%
4/4/2018	95.92614%
4/5/2018	96.20054%
4/6/2018	96.23476%
4/7/2018	96.23476%
4/8/2018	96.40170%
4/9/2018	96.58377%
4/10/2018	96.67142%
4/11/2018	96.86490%
4/12/2018	96.90530%
4/13/2018	96.97373%
4/14/2018	96.97923%

Date	Percentage
4/15/2018	97.04365%
4/16/2018	97.15160%
4/17/2018	97.17488%
4/18/2018	97.17488%
4/19/2018	97.26911%
4/20/2018	97.30760%
4/21/2018	97.53686%
4/22/2018	97.54100%
4/23/2018	97.69783%
4/24/2018	97.73938%
4/25/2018	97.83612%
4/26/2018	97.86565%
4/27/2018	97.89654%
4/28/2018	97.90577%
4/29/2018	97.98031%
4/30/2018	98.04386%
5/1/2018	98.07821%
5/2/2018	98.16314%
5/3/2018	98.25675%
5/4/2018	98.26606%
5/5/2018	98.30434%
5/6/2018	98.30821%
5/7/2018	98.44331%
5/8/2018	98.46830%
5/9/2018	98.50407%
5/10/2018	98.57352%
5/11/2018	98.62621%
5/12/2018	98.69240%
5/13/2018	98.69240%
5/14/2018	98.71921%
5/15/2018	98.79117%
5/16/2018	98.86470%
5/17/2018	98.90102%
5/18/2018	98.91806%
5/19/2018	98.93001%
5/20/2018	98.97929%
5/21/2018	99.03523%

Date	Percentage
5/22/2018	99.05838%
5/23/2018	99.07203%
5/24/2018	99.08310%
5/25/2018	99.08479%
5/26/2018	99.08900%
5/27/2018	99.09613%
5/28/2018	99.09613%
5/29/2018	99.19756%
5/30/2018	99.21636%
5/31/2018	99.30584%
6/1/2018	99.31534%
6/2/2018	99.31534%
6/3/2018	99.31534%
6/4/2018	99.34325%
6/5/2018	99.35166%
6/6/2018	99.37122%
6/7/2018	99.38167%
6/8/2018	99.42281%
6/9/2018	99.45811%
6/10/2018	99.45811%
6/11/2018	99.52593%
6/12/2018	99.55153%
6/13/2018	99.57060%
6/14/2018	99.57746%
6/15/2018	99.62030%
6/16/2018	99.62030%
6/17/2018	99.62030%
6/18/2018	99.70496%
6/19/2018	99.70496%
6/20/2018	99.67339%
6/21/2018	99.77902%
6/22/2018	99.81881%
6/23/2018	99.81881%
6/24/2018	99.81881%
6/25/2018	99.82138%
6/26/2018	99.83944%
6/27/2018	99.84087%

Date	Percentage
6/28/2018	99.85791%
6/29/2018	99.85791%
6/30/2018	99.85791%
7/1/2018	99.85791%
7/2/2018	99.86816%
7/3/2018	99.86816%
7/4/2018	99.86816%
7/5/2018	99.86816%
7/6/2018	99.89633%
7/7/2018	99.89633%
7/8/2018	99.89633%
7/9/2018	99.92940%
7/10/2018	99.92940%
7/11/2018	99.92940%
7/12/2018	99.92940%
7/13/2018	99.93517%
7/14/2018	99.93517%
7/15/2018	99.93517%
7/16/2018	99.95574%
7/17/2018	99.95574%
7/18/2018	99.95574%
7/19/2018	99.96354%
7/20/2018	99.96864%
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7/22/2018	99.96864%
7/23/2018	99.96864%
7/24/2018	99.97475%
7/25/2018	99.98235%
7/26/2018	99.98235%
7/27/2018	99.98235%
7/28/2018	99.98235%
7/29/2018	99.98235%
7/30/2018	99.98391%
7/31/2018	99.98391%
8/1/2018	99.98391%
8/2/2018	99.99294%
8/3/2018	99.99294%

Date	Percentage
8/4/2018	99.99294%
8/5/2018	99.99294%
8/6/2018	99.99830%
8/7/2018	99.99844%
8/8/2018	99.99844%
8/9/2018	99.99844%
8/10/2018	99.99851%
8/11/2018	99.99851%
8/12/2018	99.99851%
8/13/2018	99.99851%
8/14/2018	99.99946%
8/15/2018	100.00000%

Accessible Data for Figure 3: Number of Lineworkers Who Worked to Restore the Electricity Grid in Puerto Rico from November 2017 through May 2018

Date	Puerto Rico Electric Power Authority (PREPA)	PREPA contractors	U.S. Army Corps of Engineers (Corps) and Corps' contractors	New York State Utility Contingent	Utility mutual assistance
11/3/2017	850	494	491	0	0
11/10/2017	850	742	508	0	0
11/17/2017	850	1001	436	88	0
11/24/2017	850	956	1019	251	0
12/1/2017	979	467	1096	332	0
12/8/2017	1127	723	1243	315	0
12/15/2017	1026	775	1243	269	0
12/22/2017	1092	725	1540	291	0
12/29/2017	1003	638	1607	315	0
1/5/2018	953	617	1680	281	0
1/12/2018	1046	688	1730	279	0
1/19/2018	1001	700	2075	298	0
1/26/2018	975	740	2579	331	0
2/2/2018	920	713	3077	349	897
2/9/2018	958	693	2997	366	940
2/16/2018	929	644	2920	248	942

Date	Puerto Rico Electric Power Authority (PREPA)	PREPA contractors	U.S. Army Corps of Engineers (Corps) and Corps' contractors	New York State Utility Contingent	Utility mutual assistance
2/23/2018	955	625	2097	335	928
3/2/2018	887	622	1273	334	787
3/9/2018	921	652	1086	218	664
3/16/2018	907	625	977	180	571
3/23/2018	751	662	545	192	586
3/30/2018	534	620	571	182	506
4/6/2018	835	622	468	134	0
4/13/2018	649	622	576	45	0
4/20/2018	798	631	579	0	0
4/27/2018	740	603	565	0	0
5/4/2018	731	584	672	0	0
5/11/2018	725	617	674	0	0
5/18/2018	734	611	621	0	0
5/25/2018	748	592	0	0	0
5/29/2018	358	545	0	0	0

Accessible Data for Figure 5: Timeline of Federal and Other Efforts to Support Electricity Grid Restoration in Puerto Rico after the 2017 Hurricane Season

- 2017
  - Sept. 6-7: Hurricane Irma strikes Puerto Rico. 66 percent of customers without power.
  - Sept. 10: Major disaster declaration for Puerto Rico (DR-4336-PR).
  - Sept. 20: Hurricane Maria makes landfall. 100 percent of customers without power.
  - Sept. 20: Major disaster declaration for Puerto Rico (DR-4339-PR).[b]
  - Sept. 21-22: The Governor of Puerto Rico requests emergency assistance from the Governor of New York, and

New York sends its first group of 10 personnel to assist with the assessment and reconstruction of the grid.

- Sept. 26: The Puerto Rico Electric Power Authority (PREPA) awards a contract for grid restoration that is terminated effective November 30, 2017.
- Sept. 30: The Federal Emergency Management Agency (FEMA) assigns the U.S. Army Corps of Engineers (USACE) to lead planning, coordination, and integration efforts for grid restoration.
- Oct.15-18: USACE awards two contracts to assist with grid restoration.[c]
- Oct. 19: PREPA awards another contract for grid restoration.
- Oct. 31: PREPA requests mutual assistance from the electric utility industry.
- Nov. 22: The Governor of Puerto Rico appoints a Power Restoration Coordinator to oversee the multipronged restoration effort.
- Dec. 1: USACE awards a third contract for grid restoration. The total amount obligated on these three USACE-funded contracts is $1.5 billion as of June 30, 2018.

- 2018
  - Jan. 3: 58 percent of customers’ power restored.[b]
  - Feb. 10: 75 percent of customers’ power restored.[b]
  - Apr. 3: 95.8 percent of customers’ power restored.[b]
  - May 17: FEMA extends USACE’s mission assignment for temporary emergency power to November 30, 2018. It is later extended until April 8.
  - May 18: The USACE grid restoration mission ends.[d]

- June 20.: The Department of Energy made recommendations to Puerto Rico's government to inform investments in grid resilience included in recovery plans.
- Aug. 15.: 100 percent of customers' power restored.[b]

Source: GAO analysis of information from FEMA, PREPA, USACE, the Department of Energy, the New York State Utility Contingent, and the Office of the Governor of Puerto Rico.

Accessible Data for Figure 6: Timeline of Federal and Other Efforts to Support Electricity Grid Restoration in the U.S. Virgin Islands after the 2017 Hurricane Season

- 2017
  - Sept. 6: Hurricane Irma strikes the U.S. Virgin Islands.
  - Sept. 7: Major disaster declaration for the U.S. Virgin Islands (DR-4335-VI). b
  - Sept. 13: The Department of Energy (DOE) deploys personnel to advise on grid recovery in support of its mission assignment from the Federal Emergency Management Agency (FEMA). DOE also activates the Western Area Power Administration to provide emergency power restoration to the U.S. Virgin Islands in response to a request from FEMA. Sept. 16: Hurricane Maria strikes. 86 percent of customers without power.
  - Sept. 20: Major disaster declaration for the U.S. Virgin Islands (DR-4340-VI). c
  - Oct. 8, 2017: Virgin Islands Water and Power Authority (VIWAPA) applies for a $75 million FEMA Community Disaster Loan.
  - Dec. 25, 2017: 90 percent of customers' power restored.[c]
- 2018
  - Feb. 9.: U.S. Army Corps of Engineers temporary power mission complete.
  - Mar. 8.: 100 percent of customers' power restored.[c]

Source: GAO analysis of U.S. Army Corps of Engineers, FEMA, and VIWAPA documents.

Agency Comment Letter

Accessible Text for Appendix II Comments from the Department of Homeland Security

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April 2, 2019

Chris P. Currie

Director, Homeland Security and Justice Issues

U.S. Government Accountability Office

441 G Street, NW

Washington, DC 20548

Re: Management Response to Draft Report GAO-19-296, "2017 HURRICANE SEASON: Federal Support for Electricity Grid Restoration in the U.S. Virgin Islands and Puerto Rico"

Dear Mr. Currie:

Thank you for the opportunity to review and comment on this draft report. The U.S. Department of Homeland Security (OHS) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's positive acknowledgement of the Federal Emergency Management Agency's (FEMA's) unprecedented role in coordinating and directly assisting with electricity grid restoration efforts in Puerto Rico and U.S. Virgin Islands (USVI) after Hurricanes Irma and Maria in 2017. As of July 20, 2018, FEMA had obligated $3.2 billion in Puerto Rico and $795 million in the USVI in both Public Assistance grant funds and direct federal assistance through mission assignments. A top priority of OHS, FEMA and the entire federal government has been continuing to provide life safety and life sustaining

resources to Puerto Rico and USVI, including efforts to restore power and stabilize critical infrastructure.

In Puerto Rico, FEMA's 2019 Puerto Rico Contingency Plan includes the use of historical data to identify critical facilities that will need generators. To meet this requirement FEMA not only identified the number of generators needed, but also added generators with higher capacities. To improve resiliency of the electric grid in the USVI, the USVI Water and Power Authority (WAPA) is replacing wooden poles with composite poles which can withstand wind speeds of 200 miles per hour. USVI WAPA is also working on a plan to further improve resiliency by putting electric utility lines underground.

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The National Response Framework (NRF) is part of the National Strategy for Homeland Security that presents the guiding principles enabling all levels of domestic response partners to prepare for and provide a unified national response to disasters and emergencies. The NRF is one of 5 frameworks established as part of the National Preparedness System which includes the National Frameworks for Prevention, Protection, Response, Recovery, and Mitigation as well as the National Preparedness Goal. The NRF designates FEMA as the lead coordinator of the 14 agencies supporting each function for federal response efforts. In building capabilities to restore Puerto Rico and USVI electricity grids, FEMA coordinated efforts with the Department of Energy (DOE), United States Army Corps of Engineers (USACE), Puerto Rico Electric Power Authority (PREPA), and USVI WAPA.

FEMA also formed the Emergency Power Task Force (TEPTF) to validate the stock and current status of the FEMA/Federal generators that have been stored in Puerto Rico. The TEPTF will coordinate with its Federal partners to initiate the installation of generators based on Puerto Rico' s stated priorities, when needed. The TEPTF, which includes the DOE and USACE, meets quarterly to discuss topics related to interagency and private sector coordination, collaboration, and support. If needed, the TEPTF will evolve into a Crisis Action Planning Team to support FEMA's National Response Coordination Center and Regional Response Coordination Center activations.

The draft report did not contain any recommendations. Technical comments were previously provided under separate cover. FEMA

remains committed to supporting our citizens and first responders before, during, and after disasters.

Again, thank you for the opportunity to review and comment on this draft report. We look forward to working with you again in the future. Please feel free to contact me if you have any questions.

Sincerely,

JIM H. CRUMPACKER, CIA, CFE

Director

Departmental GAO-OIG Liaison Office

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